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STUDENT ESSAY

THE ARMY'S AMMUNITION GOCO BASE

ITS CHALLENGES FOR THE EIGHTIES

BY

LIEUTENANT COLONEL WILLIAM J. SCHUMACHER, OD

5 MARCH 1984



US ARMY WAR COLLEGE, CARLISLE BARRACKS, PENNSYLVANIA

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THE ARMY'S AMMUNITION COCO BASE
ITS CHALLENGES FOR THE EIGHTIES
INDIVIDUAL ESSAY

by

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1 March 1984

ABSTRACT

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Expenditure rates of ammunition have increased in every major U.S. conflict. Since World War II, the government-owned, contractor-operated (GOCO) ammunition base within the Army has been shrinking. In addition, several new forces have surfaced during the past decade which significantly impact on this base. By far, the introduction of more effective munitions has been the most dominant factor. Their complexity of manufacture and higher cost have altered peacetime production as well as mobilization capacity and responsiveness. Likewise, higher energy costs and more stringent environmental regulations have had a deleterious effect on this base. Some strides have been made in improving the responsiveness of the base. In particular, instituting a more innovative plant utilization policy and the establishment of the Single Manager for Conventional Ammunition are noteworthy. However, additional innovative approaches are needed to resolve the challenges caused by modern technology. For example, greater emphasis on computer analytical techniques and system management is needed. By far, the greatest need is for a central, high level authority for ammunition with a mandate to dampen the continual fluctuations in guidance and resources.

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INTRODUCTION

Limited resources constrain most military strategies. Ammunition, in particular, is one of those resources for which demand always seems to exceed the supply. The United States Army, as far back as the Revolutionary War, has been faced with this problem. After every major military conflict, considerable debate takes place on this issue. Despite much study, a constrained munitions supply typically reappears in the combat power equation in subsequent wars. Fortunately, the level of constraint has not been sufficient to preclude a military victory. However, upon further investigation, one quickly sees that these resources were often provided in a crisis mode which ultimately added to the cost of war and reduced the margin of success. Because of this track record, some would argue that this problem will always be with us and that the industrial base will continue to respond positively to this challenge. Or, in other words, there is no need to solve this problem. Typically, such a philosophy translates to reduced monetary resources for the ammunition industrial base during peacetime.

A decade has passed since the ammunition industrial base was last asked to respond. But unlike other peacetime periods, several new factors have arisen which impact on this base. Most of these factors, such as higher energy costs, are fairly obvious. Upon reflection, however, the magnitude of these new forces on the base becomes clearer and more significant. Unfortunately, most of these factors have the potential to further erode the responsiveness of our industrial base. Thus, another analysis of this complex issue has merit. In this

regard, this essay will limit its analysis to the impact of these new factors on the government-owned, contractor-operated (GOCO) ammunition base. This limitation, however, should not be construed as a statement that these factors do not impact the contractor-owned, contractor-operated (COCO) portion of the base or that that segment of the base is not equally as important.

If one looks back at the history of ammunition logistics, two trends are clearly evident. First, expenditure rates of ammunition have increased with each major military conflict. For example, in World War II, the U.S. industrial base produced fifty times as much artillery and mortar ammunition as that produced during World War I. During the Korean War, ammunition rates exceeded World War II levels. Even during the Vietnam period, the tonnage of ammunition shipped to that country exceeded World War II and Korean War levels.¹

The second historical trend is that the GOCO ammunition base has been shrinking from World War II levels. For example, during World War II, 84 ammunition plants were in operation and another 29 were in construction when the conflict ended. Within a short period of time, only 56 of the 113 plants were still available. By the Korean War, only 38 plants were in active use and during the Vietnam conflict, only 25 plants were in operation. Today, the GOCO ammunition base consists of 13 active plants and 11 inactive plants.²

Before discussing the factors impacting on the ammunition base, a brief overview of the GOCO complex is in order. As one would expect, most of these plants were built during the World

War II era. In the past two decades, only one new plant has been built. This facility, the Mississippi Army Ammunition Plant, began production in Fiscal Year 1983. As a general rule, the active plants are funded by the procurement appropriation and the inactive plants are funded by the operation and maintenance (O&M) account. However, any inactive facilities at an active plant which are in a layaway status are maintained using O&M funds.

These plants, elements of the U.S. Army Armament, Munitions, and Chemical Command (AMCCOM) fall into four basic production categories: propellants and explosives (P&E), small arms, metal parts, and load, assemble and pack(L/A/P). Some plants have multiple missions. That is, they have the capability to perform in more than one category. A listing of the active plants is shown in figure 1. While some of these plants have additional capabilities in a standby status, figure 1 does not reflect such information.

Active Plants

<u>P&E</u>	<u>Small Arms</u>	<u>Metal Parts</u>	<u>L/A/P</u>
Holston	Lake City	*Louisiana	Hawthorne
*Indiana		*Mississippi	*Indiana
*Kansas		Scranton	Iowa
Radford			*Kansas
			Lone Star
			Longhorn
			*Louisiana
			Milan
			*Mississippi

*Multi-mission plants

Figure 1

As noted earlier, eleven plants are currently not producing ammunition, but rather are in a stand-by mode. These plants are activated in the event of mobilization or other production demands. Typically, this cold base requires longer lead times to initiate production in comparison to the active plants. A listing of these plants is shown below.

Inactive Plants
(Stand-by)

<u>P&E</u>	<u>Small Arms</u>	<u>Metal Parts</u>	<u>L/A/P</u>
Badger	*Twin Cities	Hays	Cornhusker
*Joliet		St. Louis	*Newport
*Newport		*Twin Cities	*Joliet
Sunflower		Riverbank	Ravenna
Volunteer			

*Multi-mission plants

Figure 2

Impact of New Munitions

Of the various factors which have impacted upon the GOCO base in the past decade, the production of new munitions, by far, is the most significant factor. The influence of modern technology is especially evident in 155 mm artillery projectiles. Production can no longer be described as simply pouring molten explosives into a metal casing. Now, the production of artillery projectiles includes the use of special steels, rocket motors, and electronic components. Examples of these new, more effective 155 mm munitions are:

Rocket-Assisted Projectile--Housed within this projectile is a solid rocket motor. This

projectile has significantly increased the range of 155mm artillery weapons. Increased lethality is achieved through the use of high fragmentation steel in the warhead.

Improved Conventional Munitions (ICM)--This projectile offers increased effectiveness through the use of shaped charge submunitions which are ejected from the projectile body near the target. While not achieving ranges as great as the rocket assisted projectile, it does offer an increase in range over earlier models.

Scatterable Mines(ADAM/RAAMS)--These projectiles provide for the first time a means of emplacing anti-personnel and anti-tank mines by artillery. Range is equivalent to that of the ICM projectile. For the first time, electronic components are contained within the payload section. This technical accomplishment represents a major achievement in designing and manufacturing small electronic components which are capable of withstanding the "high g" environment of gun launch.

With the increase in effectiveness of these munitions, however, came increased complexity of manufacture and ultimately increased production cost. As will be seen in this essay, both factors impact on the GOCO base. Figure 3 shows one example of the impact of complexity on a L/A/P plant. The M107 high explosive (HE) projectile is a World War II era munition. The L/A/P operation basically consists of receiving metal parts and high explosives from two sources and then filling the projectile body with molten explosive. The L/A/P operation for the two modern munitions involve the receipt and assembly of many more components. In fact, as seen in figure 3, the rocket assisted and scatterable mines (RAAMS) projectiles have approximately three and four times as many components, respectively, as the M107 projectile.

Complexity of Modern Munitions³

<u>Projectile</u>	<u>No. of Components</u>
M107 (HE)	8
M549A1 RAP (HE)	22
M718/M741 RAAMS	37

Figure 3

What is the impact of the larger number of components in a L/A/P operation? As would be expected, one impact is increased production time. By far, however, the most significant impact is the increased risk of a production stoppage or reduced production. In other words, a shortage of any one of the components can act as a "line stopper." The shortage can be caused by either a lack of deliveries or by a quality problem which precludes the use of the components in the assembly operation. In the first case, the Army attempts to minimize the risk by stocking certain types of raw materiel, such as high explosives. For the older munitions, such as the M107 projectile, this system works quite well. However, for the new munitions which use such additional items as electronic components and rocket grains for which stockage is minimal, the system is not as effective.

The quality issue poses an even bigger challenge. As one would suspect, the larger number of components increases the potential for interface problems. For example, a new vendor may produce a component slightly out of dimensional tolerance and thereby trigger a production delay or stoppage at a L/A/P plant. In peacetime, the outcome of such a work stoppage is probably

increased cost. In a time of mobilization, however, the impact on the readiness of the Army may be more severe. Furthermore, the risk of such an occurrence in mobilization is usually greater as the number of vendors is increasing to meet the higher demand.

There is another relevant factor which relates to the quality issue. For various reasons, most of the high dollar value items in the new munitions are procured by the Army and supplied to the operating contractor of a L/A/P plant as government-furnished materiel (GFM). Unlike most missile production programs in the Army, there usually is no system contractor for an ammunition item. Thus, if GFM components do not fit or shortages occur, the L/A/P contractor has no contractual obligation to resolve the problem. Nor, does the L/A/P contractor have a contractual obligation to observe the quality program of GFM vendors so as to insure that only acceptable components are shipped to him. Thus, the cost and schedule risks under this system fall on the government.

Central procuring of selected items has been used by the Army for many years. However, with the increased complexity of our newer munitions, assigning system responsibility to a L/A/P producer on a selective basis merits serious consideration. While there are disadvantages in doing so, the benefit to be gained in reducing the risk of unacceptable components arriving at the L/A/P plant may override these shortcomings. Lowering this risk translates to lower production costs and improved readiness. Considering that the annual production budget for the scatterable mine program (i.e., ADAM, RAAMS, GEMSS, and GATOR) equals or exceeds such programs as STINGER, HELLFIRE, and

COPPERHEAD, all of which are produced by a system contractor, this concept deserves serious consideration. As a minimum, establishing a small, government project office to manage this total program would seem appropriate.

As was mentioned earlier, the higher unit cost of these new munitions also impacts on the GOCO base. This influence is especially visible in the maintenance of a warm base in peacetime and in the planning of facilities for mobilization. Earlier, we looked at the number of components for three projectiles and found that the new munitions have a much higher number of components than earlier models. As shown in figure 4, a similar effect is seen for the unit cost of the newer projectiles. One must be careful in interpreting this information, however, as some of the unit cost information is an average value for a common grouping of projectiles. Also, all projectiles are not at the same point on the production learning curve. However, it can safely be said that with increased technical sophistication comes higher unit costs.

Unit Cost Comparison⁴

<u>Projectile</u>	<u>No. of Components</u>	<u>Unit Pgm Cost</u>
M107 HE	8	\$204
M549A1 RAP	22	\$570
M718/M741 RAAMS	37	\$2987

Note: Unit program cost is the total FY83 budget estimate divided by the quantity. As such, it includes hardware cost plus all other associated costs, such as engineering support. M107 data and RAAMS data are based on general categories (e.g. ADAM/RAAMS).

Figure 4

How exactly does the higher cost of modern munitions affect the ability of the GOCO complex to maintain a warm base? If the annual procurement budget for ammunition remains fairly constant, higher unit costs translate to the production of less ammunition. Typically, this means fewer types of munitions produced as well as smaller quantities of the various types. Therefore, fewer plants are needed to produce a given item and fewer people are needed at a plant to produce the item. Figure 5 reflects the current L/A/P production of some of the new munitions discussed earlier. Except for the ICM projectile, L/A/P operations are conducted at only one plant. Furthermore, as production increases at the Mississippi Army Ammunition Plant, the number of plants producing the ICM projectile will probably decrease.

Current L/A/P/Producers⁵

<u>Projectile</u>	<u>No. of Active Producers</u>
Rocket-Assisted (RAP)	1
ADAM (Anti-Personnel)	1
RAAMS (Anti-Tank)	1
Improved Conv. Munitions	4

Figure 5

The smaller quantity of modern munitions produced during peacetime usually means fewer production personnel. As seen in figure 6, the base has been able to expand when necessary to meet increased production demands.

Employee Population for Six L/A/P Plants⁶

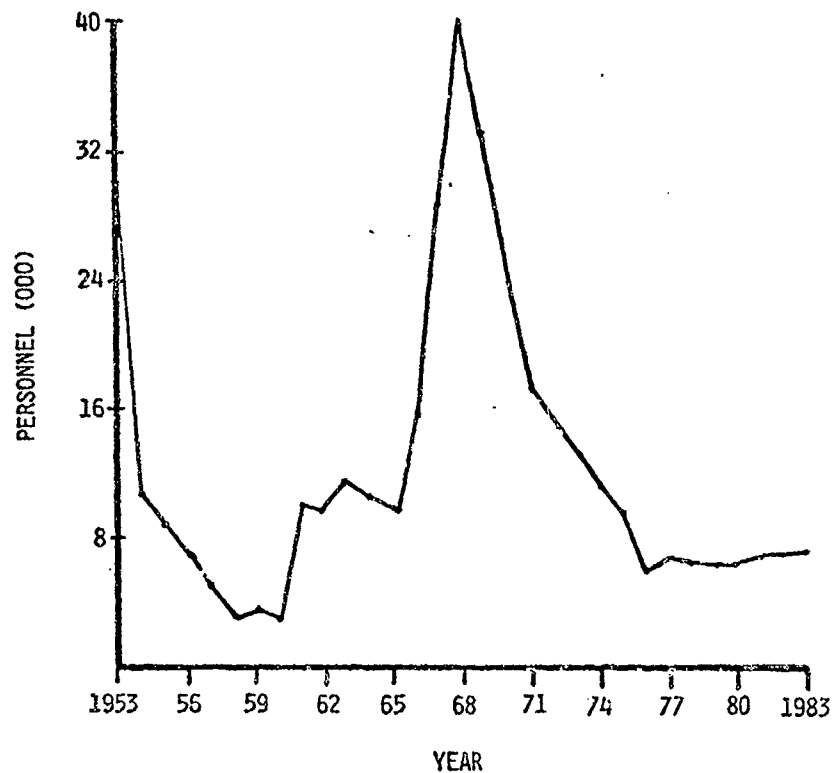


Figure 6

However, are the conditions the same today? I submit that they are not. For example, less than ten years of low production occurred between the peak demand periods of World War II, Korea and the Vietnam War. Thus, a pool of experienced personnel could be tapped each time the base expanded. However, over ten years have elapsed since the peak demand of the Vietnam period. With each passing year, the reservoir of experienced personnel outside the active base dwindles. Also, the technology to produce munitions varied little during the 1940s through the 1970s. With the introduction of the newer munitions in the 1970s, manufacturing technology began to change. While much of the new manufacturing is automated, time, a precious

resource during mobilization, will still be required to train personnel.

The ability of the base to produce the older munitions is also affected by the introduction of modern, more costly ammunition. As was mentioned earlier, affordability constraints usually result in fewer types of munitions being produced. As would be expected, the newer munitions consume a significant portion of the ammunition procurement budget. For example, the four projectiles listed in figure 5 represent about twenty percent of the Fiscal Year 1984 ammunition budget. If the 8-inch versions of the ICM and RAP projectiles, as well as the Copperhead projectile are included, the portion grows to 33 percent. In other words, a third of the annual procurement budget for ammunition is consumed by just seven of the newer munitions. As a result, less funds are available to produce the older munitions during peacetime. Without such production, the training proficiency of employees in the active base decreases. As many of the older munitions are labor intensive, the lack of trained personnel could have significant implications on safety as well as responsiveness during a period of rapid growth.

Not producing the older munitions in peacetime can have other ramifications as well. For example, civilian industry is undergoing a major evolution and many of the older, small vendors are disappearing. For many of the older munitions, the design is based on twenty to thirty year old technology. Also, little monetary resources are being expended to maintain the technical data packages (TDP) of these items in a "ready to produce" configuration. Without peacetime production, these

shortcomings are not being detected. Finding them during mobilization is certainly not the optimum solution.

While GOCO plant contractors annually submit an Industrial Preparedness Plan (IPP), the producibility of inactive items is not adequately addressed. As these contractors are in the best position to determine the producibility of these items, the IPP format should be revised to require such an assessment. For this effort to be productive, however, the Army must provide a current TDP to the contractor and update it promptly after receipt of the contractor's comments.

There is another element related to the new munitions that merits discussion. Because of the cost and capabilities (e.g., mines) of these munitions, few are authorized for training. For example, none of the items listed in figure 5 have a training requirement. Prior to the introduction of the newer munitions, a warm base was enhanced by peacetime production required to support training requirements. However, for the newer munitions, this will not occur. Thus, as stockage levels of these items rise, the "affordability" influence in future years will call for a cessation of production for these items. When this happens, responsiveness will be reduced as the base for these items will become cold. One can already begin to see this effect in the out-year buys for the M549A1 projectile.

Numerous Army leaders have stressed the need for low cost ammunition devices for training. Considering the wealth of engineering and manufacturing talent that exists at the GOCO plants, it is surprising that these Operating Contractors have

not entered this market. Certainly, the current plant utilization policy, which will be discussed later, enhances this opportunity. In any event, improved coordination and communication between AMCCOM and those government agencies responsible for training devices should be pursued.

Earlier it was stated that with a fairly constant budget, higher unit costs mean less munitions produced. With the increased defense expenditures in recent years, the ammunition budget has actually grown. However, as noted in figure 7, the increase has not been as great as for the total Army procurement budget.

Army Procurement vs Ammunition Procurement⁷
(FY84 \$M)

<u>Fiscal Year</u>	<u>Procurement</u>		<u>Change</u> [*]	
	<u>Total</u>	<u>Ammunition</u>	<u>Total</u>	<u>Ammun.</u>
80	8516	1500		
81	12246	1815	+30.4	+17.4
82	15516	2589	+21.1	+29.9
83	16259	2200	+4.5	-15.0
84	19192	2334	+13.9	+5.7

* Percent Change over Previous Year

Figure 7

As would be expected under the Army's current modernization program, the procurement portion of the annual budget has grown significantly in the past five years. Except for one year, however, an equivalent increase in the procurement

of ammunition has not occurred. In fact, a negative change occurred in the FY83 budget. Starting in that same fiscal year, another change occurred. During the FY78-82 period, the ammunition budget was the third largest element of the five categories within the procurement budget. In Fiscal Year 1983, it dropped to the fifth position. For Fiscal Years 1984 and 1985, it appears that the ammunition budget will retain this last position. For the short term, the GOCO base is receiving additional funds, but not of the magnitude of the other segments of the industrial base. As large defense budgets tend to be cyclic, retention of this low priority in the future can have serious consequences. Furthermore, with the introduction of additional modern munitions (e.g., GEMSS and GATOR), as well as the influence of the Army's modernization program, it is highly likely that the quantity of munitions produced in the GOCO base will remain constant or shrink in future years. Thus, the challenge of maintaining a warm base will continue to exist.

Modern munitions have also had an impact on the industrial capacity available for mobilization. To understand this effect, a brief explanation of the method for determining the Army Acquisition Objective (AAO) for a ammunition item is necessary. Simply stated, the AAO is that quantity of a munition required to equip and sustain a force through some prescribed combat period. The AAO is calculated through the use of a complicated computer program. Using a scenario based on the assumed threat that might exist in the fifth year of the Program Objective Memorandum(POM) as well as our planned force structure for that year, the total

quantity needed to fight is estimated. As in any computer war game, a set of assumptions is used. One important parameter in this computer program is equipment density. This parameter is subject to frequent and significant fluctuations especially in light of the Army's major emphasis on modernization. Likewise, assumptions on the future force structure can significantly alter equipment densities (i.e., the recent emphasis on light divisions).

In addition to equipment density, one must estimate weapon expenditure rates (e.g., number of rounds fired per weapon per day). Historical data can be used as a basis for estimating rates for munitions previously fired in combat. However, for the newer munitions, little or no combat data is available, and thus, estimated rates may not be as valid. Using these parameters as well as other assumptions, the computer program determines ammunition requirements. This output is then added to any special requirements (i.e., project stocks) and the total becomes the AAO. After subtracting the assets on hand and adding any training requirements to this value, the remainder represents the procurement requirement for the five year period in question. In theory, the total quantity procured by the fifth year should be sufficient to fight a war under the assumed scenario and force structure. As one would expect, other factors, such as the affordability issue, may cause an adjustment in the quantities procured annually.

For a variety of reasons, some of which have been discussed above, the AAO can vary appreciably. At first glance, one is apt to say that this variability can be compensated for in the

Planning, Programming, and Budget System (PPBS). Unfortunately, the impact of a varying AAO on the GOCO base is complex and simply adjusting annual peacetime buys will not solve the problem. The most significant problem stems from the fact that the sizing criteria for initial production facilities is based on the AAO. Thus, as the AAO goes up and down, planners are faced with the difficult task of adjusting the design and ultimately the budget submissions sent to Congress. To cite one example, the monthly mobilization requirement for the 5.56mm round ranged from a high of 306 million rounds in 1973 to a low of 59 million rounds in 1980.⁸ Suffice to say, the Army's ability to justify annual buys as well as new facilities is not always successful in such an environment.

To compound this problem even more, the facility sizing guidance provided to the planners has varied considerably in the last few years. As noted by the General Accounting Office (GAO) and displayed in figure 8, the guidance for initial production facilities has caused a considerable shrinking of production capacity for the new munitions. As seen in this figure, in just over two years, the guidance changed from providing a facility to support total mobilization to providing only the capacity to support the Five Year Defense Program Buy. To further exacerbate this situation, the Program Defense Memorandum (PDM) stated that the annual buys should be produced on a two shift basis thereby leaving little capacity for surge.⁹ Thus, even if the Army is able to surmount the problems previously discussed (e.g., increased components), it is still faced with a capacity

problem for the newer munitions.

Sizing Criteria for Initial Production Facilities¹⁰

<u>Time Frame</u>	<u>Guidance</u>
POM covering FY78-82	Facilities sized to support total mobilization.
POM covering FY79-83	Sizing reduced to equivalent of 180 day AAO
POM covering FY80-84	Further reduction to 90 day AAO (plus NATO)
PDM covering FY80-84	Further reduction of facility sizing to that supporting the Five Year Defense Plan Buy.

Figure 8

Up to this point, the discussion has centered on the industrial capacity for the new munitions. But, what about the base for the older munitions and how has the introduction of the newer munitions affected this capacity? As was mentioned earlier, most of the existing GOCO ammunition base dates back to World War II. Because of concern about the deterioration of this base, the U.S. Army, in the early 1970s, embarked upon a major program to revitalize it. The objective of this program was to upgrade facilities in the most efficient way, using the latest proven manufacturing technology, such that the modernized facilities would require less start-up time, reduce unit production costs and eliminate numerous environmental, health, and safety hazards.

Because of the size and complexity of this endeavor, the Secretary of Army established a Project Manager for Munitions and Production Base Modernization and Expansion (PM-PBM). As the

title of this organization implies, the intent of the program was to modernize and expand the base. Unfortunately, after a decade, this goal has not been achieved. In fact, after less than a decade, the project office was disestablished and is now an agency reporting to the Commander, U.S. Army Armament, Munitions, and Chemical Command (AMCCOM).

Part of the problem in not fully modernizing the base stems from the fact that the new munitions began to enter production just as the Project Manager's efforts got underway. As a result, the facilitization for the modern munitions diverted monetary resources away from the modernization effort. The extent of this influence is easily seen in figure 9.

PBM Projects¹¹
Percent of Modernization

<u>FY</u>	<u>%</u>	<u>FY</u>	<u>%</u>
70	99.5	77	31.7
71	98.4	78	22.6
72	99.2	79	24.0
73	90.6	80	0.2
74	27.5	81	8.0
75	52.1	82	33.5
76	41.7	83	39.8
76T	89.3	84	6.3

Figure 9

The total funds provided to the PBM Office since 1970 exceed \$3 billion. Only a third of this amount has been used to modernize facilities. Furthermore, of that \$1 billion, little has been spent on upgrading the inactive facilities. For

example, of the roughly 280 modernization projects contained within the \$1 billion, only 64 projects, less than 3 percent, have been for the inactive plants.¹² Thus, little upgrade of the "cold base" portion of the GOCO complex has occurred in the past decade.

In addition to the expenditure of one billion dollars for modernization, an equivalent amount has been spent on expansion of the base. Many of these projects are for the newer munitions. Within this category are several facilities which will not be used in peacetime, and as a result, will be laid away after initial prove out. In accordance with the objectives of the modernization program, these facilities are highly automated so as to increase productivity and safety. While these projects are a definite asset to the Army's mobilization posture, they do pose a new challenge in maintaining them in a satisfactory layaway condition. In particular, innovative and diligent efforts will be needed to maintain the numerous pneumatic control systems and computers in a satisfactory condition. Thus, while modern automation technology can improve safety and efficiency, it also presents a significant new challenge in maintaining such facilities in layaway.

Also, affordability constraints and the size of these automated facilities often preclude fully proving out the entire facility simultaneously. For example, a \$25M detonator facility at one of the active L/A/P plants is of such a magnitude that sufficient funds are not available to prove out the entire facility. While at least one piece of each type of equipment will be tested, there is still some risk that this facility, when

activated from layaway, may not be capable of operating at maximum rate.

Because of the risks discussed above, serious consideration should be given to workloading automated facilities, such as the detonator production line, at low production levels in lieu of laying them away. Even if this approach can only be accomplished periodically or for some facilities, improved readiness should result. With the current emphasis on minimizing peacetime production costs rather than improving industrial preparedness, implementation of such an approach is highly doubtful. Regardless, a more comprehensive study of stockage levels versus industrial capacity is needed.

Before discussing layaway further, a few additional comments on the environment in which budget submissions for facility projects are prepared are in order. As was previously mentioned, a varying AAO impedes this process. Another varying parameter is the total obligation authority (TOA) for production base support. For example, the TOA for Fiscal Year 1984 varied from a high of \$471M in October 1981 to \$196.2M by October 1983. In that same timeframe, the FY85 TOA varied from \$429.1M to \$222.8M.¹³ As can be seen, funding the deferred FY84 projects in FY85 will be difficult as that budget has also been reduced significantly. While the phenomenon of varying budget guidance is not unique just to this area, the frequency and degree of these fluctuations appear to be greater than the norm. Needless to say, a fluctuating TOA complicates any planner's task.

The development process for new munitions can also impact on

the budget submission process. For example, in the latter stage of a development program, preliminary facility designs and budgets submissions are prepared. As can occur in the development of any complex item, engineering problems or other factors may delay the initiation of production. These schedule delays can impact on the production base support budgets. In some cases, adjustments cannot be made in time and, as a result, monetary resources are lost to the Army during the budget review cycle.

Layaway

It is Department of Army policy that industrial facilities which are needed for mobilization, but not required to support current peacetime production, are to be placed in layaway. Such facilities may be an entire plant, as those shown in figure 2, or just a portion, as in the earlier discussion of the \$25 M detonator facility. Regardless of the size or location of a facility which is in layaway, Operation and Maintenance (O&M) funds must be used to maintain it in a satisfactory condition. Historically, O&M dollars have been a precious resource and are always in demand. Thus, while expanding the GOCO base adds to improved industrial readiness, placing these facilities in layaway does pose an additional burden on the operating portion of the Army budget.

In Fiscal Years 1979 and 1980, O&M funds represented about 33 percent of the total Army budget. In the next two succeeding years, this percentage increased to 35. However, in Fiscal Years 1983 and 1984, the O&M portion decreased to 32 percent,

primarily due to the large increase in investment funds in those years. With the continuing modernization program in the Army, it is highly likely that the O&M portion of the budget will remain at the FY84 level or decrease further.

O&M funds have a significant bearing on the cold base portion of the GOCO complex. In an active plant, procurement funds, by and large, pay for the operation of the facilities. In an inactive plant, however, operations are primarily funded by O&M dollars. If the amount of O&M funds available to the total GOCO base remains fairly constant, laying away facilities at active plants can divert monetary resources away from the inactive plants.

There are several causative factors for the increase in the number of facilities in layaway at active plants. Three of them relate to the introduction of the newer munitions. First, as discussed earlier, the new munitions consume a significant portion of the ammunition budget in peacetime. For this reason, as well as other factors, some of the older munitions are not being produced during peacetime. Thus, these facilities are laid away. Second, as mentioned earlier, some of the facilities for the new munitions are not needed in peacetime. Therefore, these facilities become candidates for layaway. Third, the higher cost of the new munitions and the competitive environment among the Operating Contractors of the plants dictate that operations be consolidated wherever possible. Again, those facilities not needed for peacetime can be laid away. At the present time, it is doubtful that the laying away of facilities at active plants is hurting the cold base. However, as increased

defense budgets tend to be transitory in nature, the long term implications of this issue warrant further investigation.

Energy

Another factor that has become more dominant is energy. The rise in fuel prices over the past decade has touched every citizen in our nation. For the typical homeowner, increased fuel costs has meant less funds are available to operate and maintain the home. The same can be said to be true for the GOCO base. Unless fuel consumption is reduced, the only alternatives are higher procurement costs for ammunition, or, less ammunition. For inactive plants, the increased cost of utilities translates to a higher cost to maintain the cold base or less maintenance performed at these plants. For these reasons, the GOCO base has a very aggressive energy reduction program.

Energy plays a major role in the production of ammunition. For example, it has been estimated that roughly twenty percent of the cost to L/A/P a M549A1 RAP projectile is directly related to energy. Through a concerted effort by AMCCOM and the Corps of Engineers, significant reductions in energy consumption have been made. For example, the performance of six of the active L/A/P plants for the FY78-FY82 period is shown in figure 10. As seen, by Fiscal Year 1982, the consumption of utilities has been reduced by 15 percent from the FY78 level. For the inactive base, the reduction was approximately three percent in the same time period. Unfortunately, as seen in the same figure, the cost of utilities purchased from the local economy by these plants has increased at a greater rate than the reduction in

consumption. While fuel prices have stabilized at the present time, the long range impact of this factor on the ammunition production base cannot be forgotten. For the short term, continued high priority support by the Army for the funding of additional energy reduction projects is needed. This is especially true for the inactive plants which have received little benefit from this program so far.

Energy Performance¹³
(Six Active L/A/P Plants)

<u>FY</u>	<u>Reduction in Consumption</u>	<u>Cost Increase</u>
78		
79	1.8	2.8
80	13.0	35.0
81	17.0	40.0
82	14.9	75.7

Note: Percentages are cumulative.

Figure 10

Environmental Issues

Another factor which has gained major national interest in the past decade is the environmental issue. While most will agree that upgrading the quality of our air and water was long overdue, the cost impact on private industry has been enormous. Likewise, the GOCO base has not been immune from these forces. To illustrate this point, the following example is provided.

For many years, the normal method of destroying explosive waste was to burn it on the ground outdoors. In the past decade,

some states have established laws which prohibit this practice. At one of the active L/A/P plants, the outdoor burning lasted only two to four hours each week. In lieu of this practice, the plant now utilizes two incinerators valued at more than \$2 million. Because of the capacity of these facilities and safety considerations, the time to destroy explosive residue is now appreciably greater. Thus, this one regulatory requirement has generated an additional recurring cost as well as a one time cost of \$2.5 million.¹⁵

While the additional operating cost of the incinerators in peacetime is not desirable, the potential impact of these facilities during mobilization can be more severe. For example, if the incinerators are unable to keep up with the higher demand during mobilization or if the incinerators become nonoperational for an extended period of time, the only option currently remaining is to store the waste. Such a situation usurps valuable storage space, increases the safety hazard, and results in the imposition of additional environmental restrictions. To preclude this situation from happening, means should be pursued to obtain advance approval from regulatory agencies for the outdoor burning of explosive waste under such emergencies.

The factors discussed so far have been shown to have a detrimental effect on the GOCO base. Before completing this essay, it is worthwhile to look at two factors which have had a positive effect during the past decade. The first supportive influence relates to the establishment of a new plant utilization policy which permits direct subcontracting at the GOCO plants.

Plant Utilization Policy

Until a few years ago, the only method by which GOCO plants received production orders was by workloading. Under this method, Army planners would attempt to assign work at the various plants so as to maintain a balance between a warm base and low production costs. As noted earlier, the influence of modern munitions made this task more difficult. During this same period, another force was influencing the base. Potential production from other weapon programs, especially in the missile area, began to evaporate due to the acquisition strategy planned for these programs. In particular, this strategy called for a prime contractor with overall system responsibility. While such an acquisition strategy had merit for the individual programs, it had a detrimental effect on the GOCO base as there was no mechanism available to permit the system contractor to use this base. To resolve this problem, several new methods were tried. From this effort, a direct subcontracting method, commonly called "third party" work, evolved.

Under this method, a prime contractor who is preparing a reply to a government request for production of a new weapon system may consider using the Operating Contractor of a GOCO plant as a subcontractor. If the Operating Contractor desires to participate, he will request permission from AMCCOM. If approved, the authorization typically will stipulate certain conditions under which this work may be performed (e.g., lower priority than other workload). If these conditions are acceptable to the Operating Contractor, he will respond to the prime contractor's solicitation. Assuming that the prime

contractor is awarded the contract and the Operating Contractor's response is acceptable to the prime contractor, the work will be performed at the GOCO plant.

This method has several advantages. First, the individual cost of other programs at the plant are reduced as the "third party" work assumes an equitable share of the overhead cost (e.g., utilities). Second, the additional work aids in maintaining a warm base at that plant. Third, if the facilities being used had been in layaway, the "third party" funds defray the cost of O&M dollars to maintain these facilities during the period that they are in use.

There are some minor disadvantages to this method however. While the government staff at the plant is not responsible for the performance of this work, the commander is still responsible for the safety of the operations. Therefore, the government staff must stay abreast of activities in this area. In all probability, the biggest disadvantage is that this method limits AMCCOM's options in balancing workload across the base as that command has no control over which plant will perform the work. Despite these drawbacks, the direct subcontracting method does enhance industrial preparedness.

Single Manager for Conventional Ammunition

After World War II and the Korean conflict, the need for a single manager for conventional ammunition was studied. However, it was not until after the Vietnam War that this concept came to fruition. In November 1975, the Deputy Secretary of Defense assigned to the Secretary of the Army the responsibility to

perform as single manager for conventional ammunition. For a variety of reasons, progress in fully implementing this management system has been very slow. Despite the past and present difficulties, however, this system does offer significant advantages to the GOCO base. In particular, the ultimate objective of involving the Single Manager for Conventional Ammunition (SMCA) in decisions related to when and how much ammunition should be produced for the various services will materially aid in maintaining the base at the optimum condition. This program appears to be at that point where the eight years of difficult and challenging work are beginning to reap major dividends for the Department of Defense.

As we have seen, several new forces have surfaced during the past decade which significantly impact on the GOCO base. By far, the introduction of more effective munitions has been the most dominant factor. Their complexity of manufacture and higher cost have altered peacetime production as well as mobilization capacity and responsiveness. Likewise, higher energy costs and more stringent environmental regulations have had a deleterious effect on this base. However, some strides have been made in improving the responsiveness of the base. In particular, instituting a more innovative plant utilization policy and the establishment of the Single Manager for Conventional Ammunition are noteworthy.

Throughout this essay, other means of enhancing the GOCO base have been suggested. In the final analysis, two major ingredients are needed. First, more innovative approaches are

needed to resolve the challenges generated by modern technology. For example, computer war games are gaining widespread use as a means of analyzing various military strategies. Using this technique to analyze various alternatives in the area of industrial preparedness has equal application. Unfortunately, this management tool appears to have little use in industrial planning at this time.

The second ingredient, and by far, the more important one, is the need for a central, high level authority for ammunition. In particular, greater emphasis on industrial preparedness is needed to dampen the continual fluctuations in guidance and resources. As with training, it is very difficult to objectively determine how much ammunition is enough. Without a strong proponent, consistent support to this important area of our military power is doubtful.

ENDNOTES

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